

Technical Information/Website Preservation

KSC NASA MUST 2010 Technical Research Paper

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- *Shortfalls and resolutions of STEM fields in 21st century education*
- *Space Shuttle hydraulics, including the Auxiliary Power Unit and Hydraulic Pump Unit*
- *Technical Information & Website Preservation for future launch vehicle Program*

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Background

The National Research Council and the National Science Foundation consider career fields in science, technology, engineering, and mathematics (STEM) to be the core technological underpinnings of an advanced society. Although this statement makes a great deal of sense, the National Commission on Mathematics and Science ranks American High School students almost last in mathematics and physics. In an effort to curb this shortfall, former U.S. president George W. Bush introduced the American Competitive Initiative – a significant budget increase to support the research and development of STEM disciplines.

The American Competitive Initiative paved the way for NASA to implement a variety of scholarship and internship programs also with the spirit to advance STEM education. These programs provide K-12, undergraduate, and post-graduate support to skilled and talented students who choose to pursue a STEM field career. I am a privileged participant of one of these programs - NASA's Motivating Undergraduates in Science and Technology (MUST) Project.

Mission of the MUST Project

The MUST Project seeks out to recruit the nation's best and brightest undergraduate college students in science and engineering. NASA supports MUST Scholars by providing mentorship, professional development activities, tuition reimbursement, and a 10-week NASA center technical research project.

10-week NASA center research overview

APU/HYD Fluids Team

With just two semesters remaining until graduation, I am grateful to have gained real-world experience by working alongside an excellent team of NASA engineers. Namely; Ms.

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Carol Bacque, Mr. Shaun Butts, Mr. Pat Cahalan, Mr. Jerry Dougherty, Mr. Tom Draus, and Mr. Slade Peters. In addition to providing individual guidance with my appointed technical research project, each engineer also graciously took the time to teach me the critical procedures required for a successful Space Shuttle flow.

Auxiliary Power Units (APU's) and Hydraulic Pump Units (HPU's)

The Space Shuttle's hydraulic function consists of two separate systems. One system is in the Orbiter, and the other is in each Solid Rocket Booster (SRB). The Orbiter's hydraulic system controls the brakes & landing gear, rudder/speed brake, main engine gimballing, and aerodynamic surfaces (*Fig. 1*). The SRB's hydraulic Thrust Vector Control (TVC) system gimbals the SRB nozzles on ascent (*Fig. 2*).

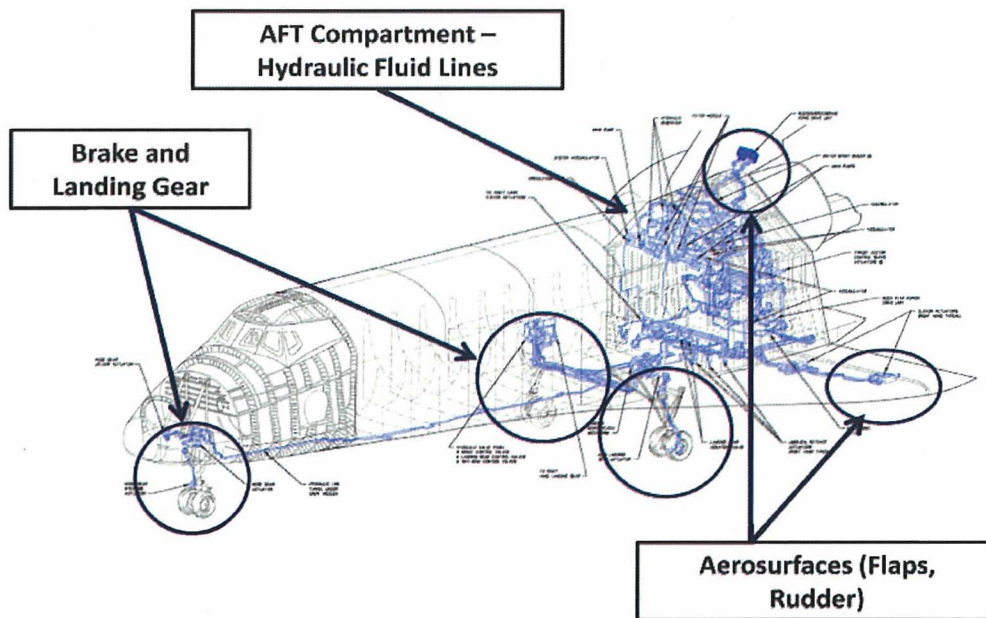


Fig. 1 – Overview of Orbiter Hydraulic System Diagram

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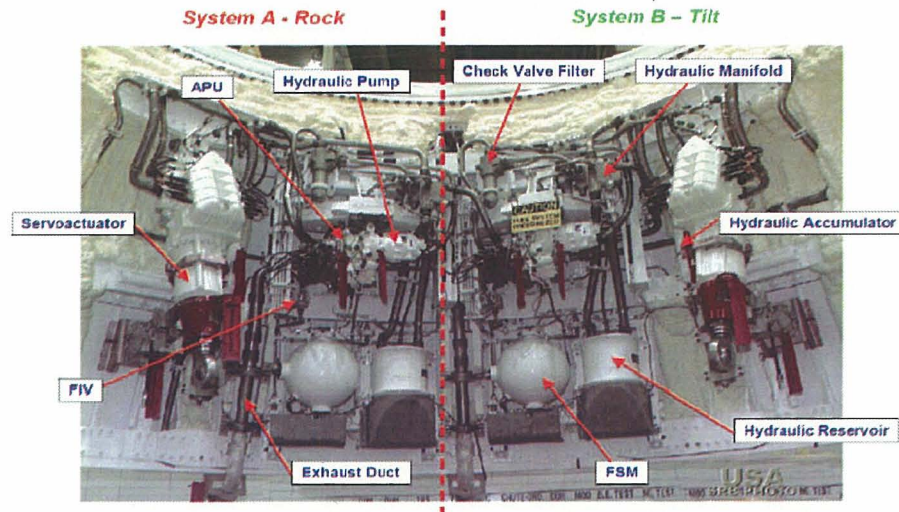


Fig. 2 – Solid Rocket Booster (SRB) Thrust Vector Control system (TVC)

Three Auxiliary Power Units in the AFT compartment of the Orbiter (*fig. 3*) and two beneath each Solid Rocket Booster (*fig. 2*) power the Space Shuttle's redundant hydraulic systems. The primary components of the APU's are a fuel feed system, a dual-stage turbine, and a set of reduction gears. Via these reduction gears, the turbine operates a fuel pump, and lube oil pump.

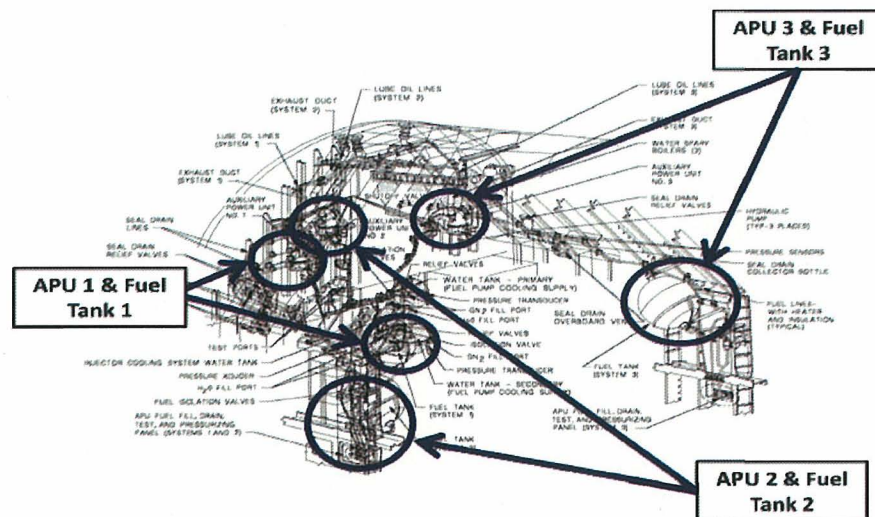


Fig. 3 – Skeleton drawing of APU/HYD system

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In the APU, liquid hydrazine enters the decomposition chamber of a gas generator and reacts with iridium-coated pellets (*figs. 4 & 5*). The chemical reaction produces a hot pressurized gas that spins the turbine, driving the reduction gears, and provides the power to operate the hydraulic pump.

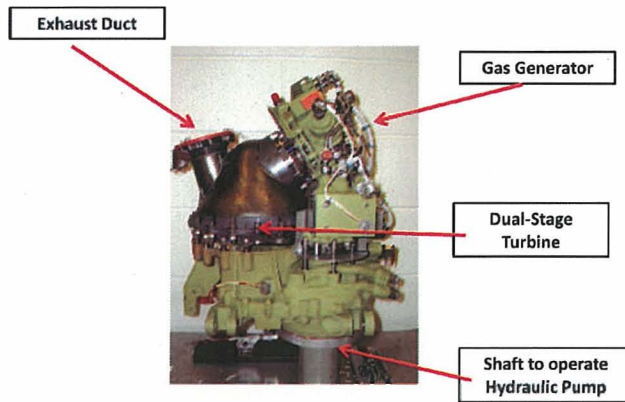


Fig. 4 – APU Exterior View

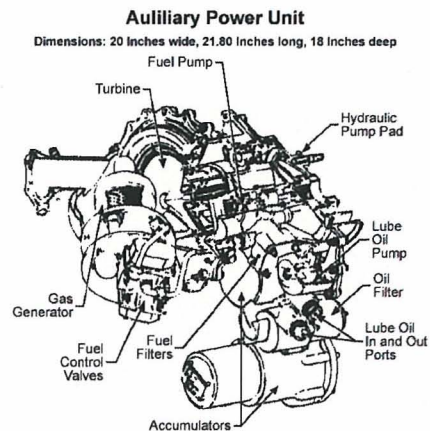


Fig. 5 – APU Interior View

Space Shuttle Retirement & Website Preservation

Future NASA launch vehicle programs may benefit from historically proven technologies. This will allow us to take advantage of lessons learned from the past, providing safety, cost reduction, performance, and training for future programs with similar systems.

With the expected retirement of the Shuttle Program, NASA will need to preserve certain APU and SRB hydraulics technical content currently contained on various contractor servers in the form of engineering team websites. This preservation will allow future access to critical Space Shuttle system information. Thus, my summer project is to preserve this technical content.

My initial approach to preserving the technical content was to create a sub-folder like structure in the Windows folder directory that would resemble the pattern of the web site itself.

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However, due to file-naming character limitations in Windows, the first approach quickly became too complex.

After manual efforts and research, it became clear that this project would require a thorough understanding about the inner workings of a website. Therefore, the second approach was to learn the nature of a website and automate the backup process via the aid of open-source website copier software. This approach effectively created a carbon copy (mirror image) of the original website to a local directory of our choosing.

What is a website?

Similar to any folder in our personal computer, a website is a file folder stored in a web server that contains web pages, images, videos, and other files. This file folder has a specific structure that allows an end user (you and me) to access the stored content via a unique URL (Universal Resource Locator) web address. Hence, the web server ‘serves’ the information to us upon our request.

What is a web server?

A web server is the computer that contains the website mentioned above (*Fig. 6*).¹

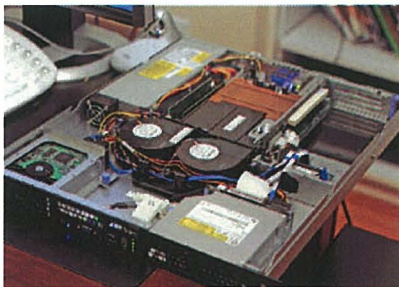


Fig. 6 – Web Server

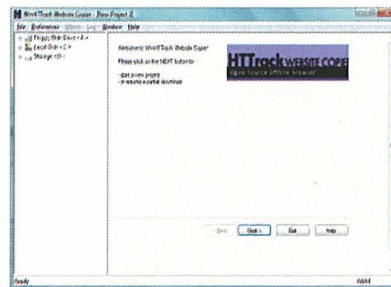


Fig. 7 - Web-Site Copier Program

¹ A collection of rack mounted web servers is a Web Farm.

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What is a website copier program?

A website copier program is a software application program (*Fig. 7*) that visits a web server and transfers files to a new folder created in a specific location of our local directory. Due to its user-friendly features and many capabilities, I chose to use HTTrack for this specific project.

How do we know it works?

We can verify its functionality by opening the locally stored web site with an offline web browser. What we will notice is that the URL path name is now pointing directly to our locally stored folder files rather than the World Wide Web location (See **Difference in URL's** below).

World Wide Web: <http://www.longislandmadd.org/>

Local Disc:

<file:///D:/Documents%20and%20Settings/crey/Desktop/MADD%20offline%20website/www.longislandmadd.org/index.html>

Project Foresight

APU/HYD in Future Launch Vehicle Programs

Although I am working with Boeing and NASA Information Technology to find a solution for a minor access issue in one of our target websites, the second method has proven to be the best approach thus far in preserving the information. Successful preserved technical information from previous program engineering websites can contribute to the development of future launch vehicle programs, and I feel fortunate of having contributed to that effort.

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Introduction

Upon the expected retirement of the Shuttle program, NASA will need to preserve certain technical content now displayed in various contractor websites. This preservation will allow future access to critical Space Shuttle system information.

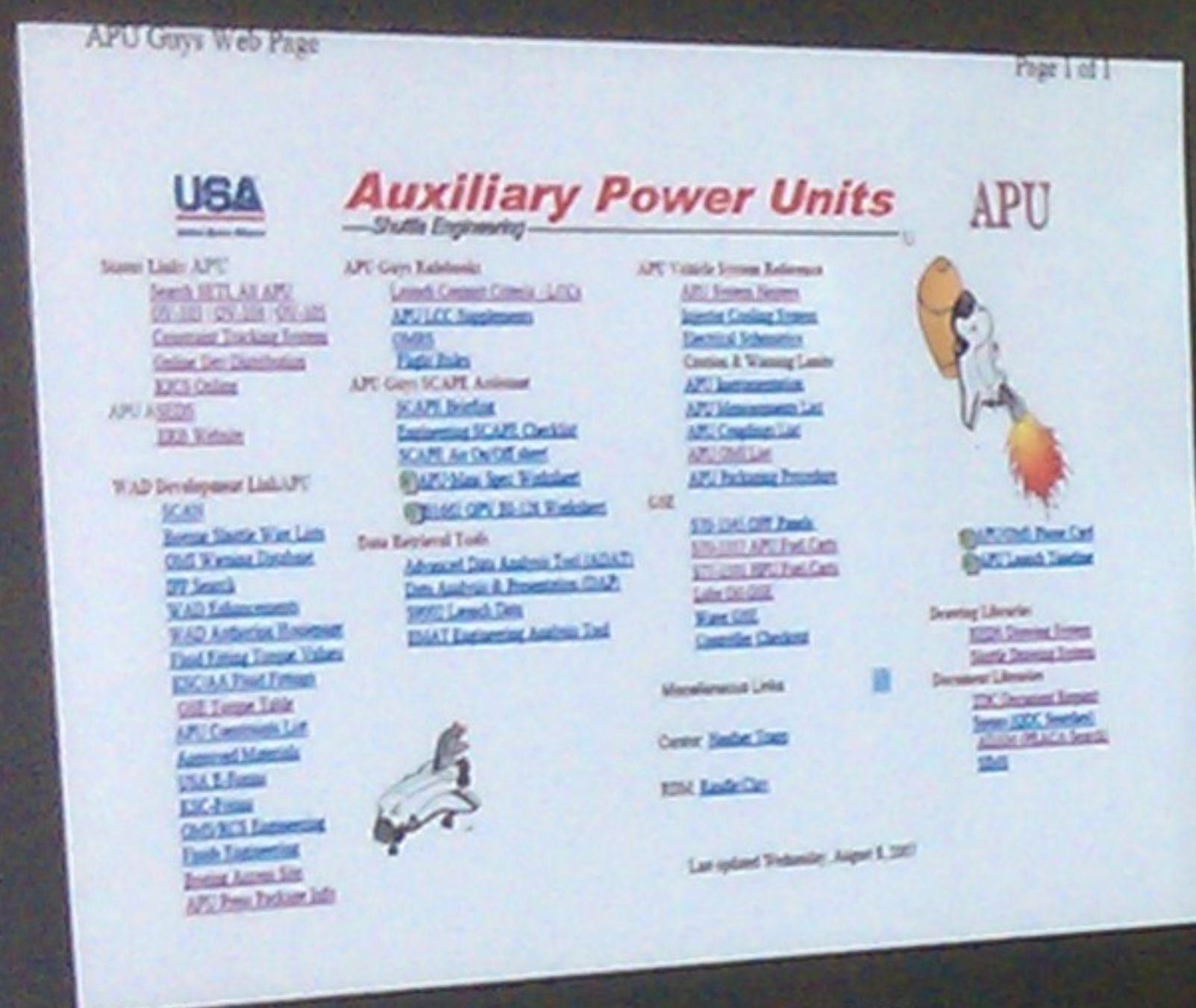


Fig. 1. APUGuys webpage

Hypothesis

Originally, I expected this project to be a simple copy/paste task. However, after various troubleshooting techniques, it became clear that this project would require a thorough understanding of the inner workings of a website.

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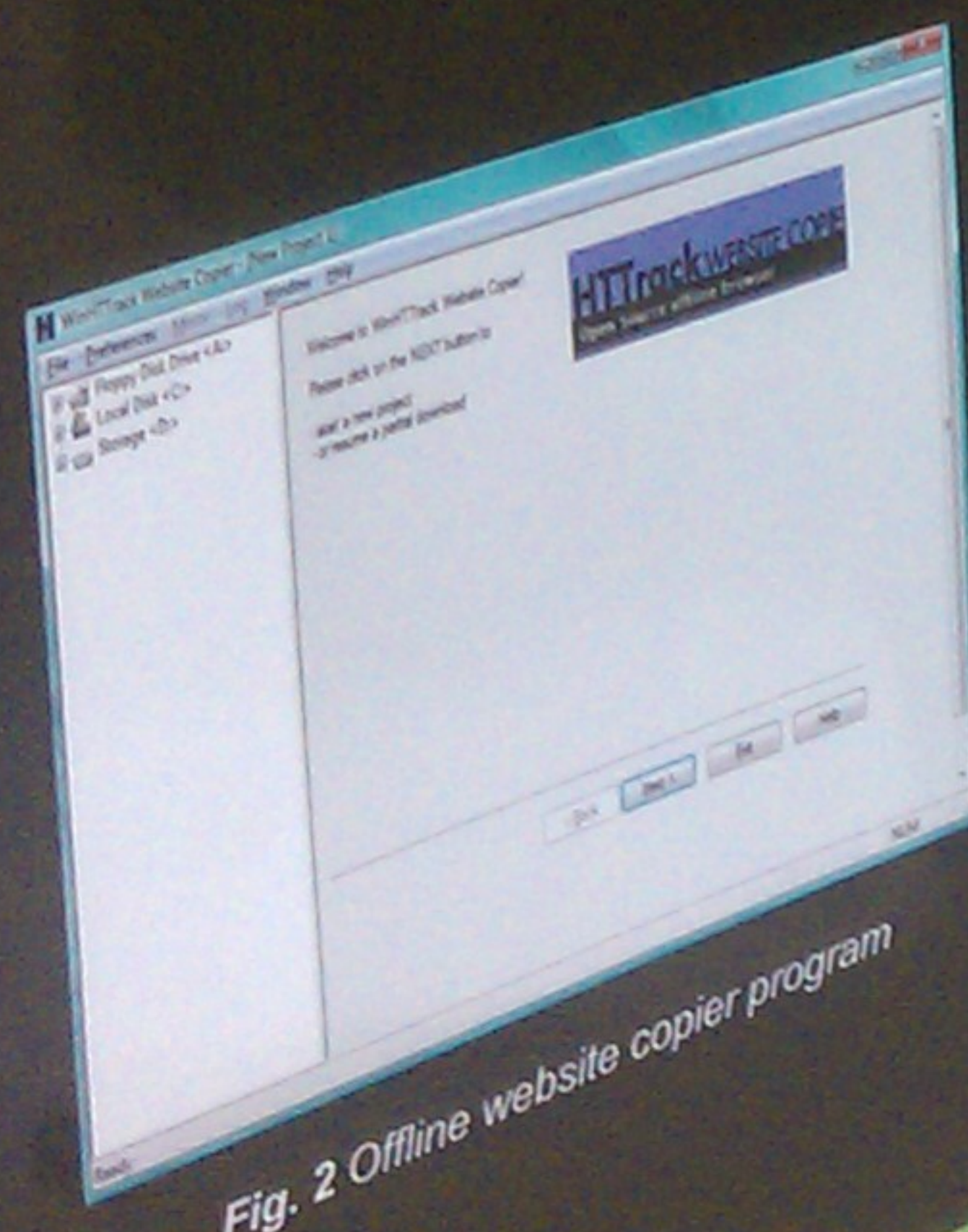


Fig. 2 Offline website copier program

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Results

The offline website copier program effectively created a carbon copy (mirror image) of the original website to a local directory of our choosing. In addition, the following benefits also stood out:

- Technical content is stored in a secure local disc
 - Content is stored in a permanent secure & accessible location
- End-user simplicity
 - The access to the content is as straight forward as using the original website
- Time efficiency
 - Learning how to use the offline website copier was simple and easy
 - Getting the application ready for use takes less than five minutes
 - Starting and running the software can be accomplished with the less than five clicks
 - On most websites, the actual mirroring project takes just minutes

Process from Start to Finish... Figures 3a – 3h

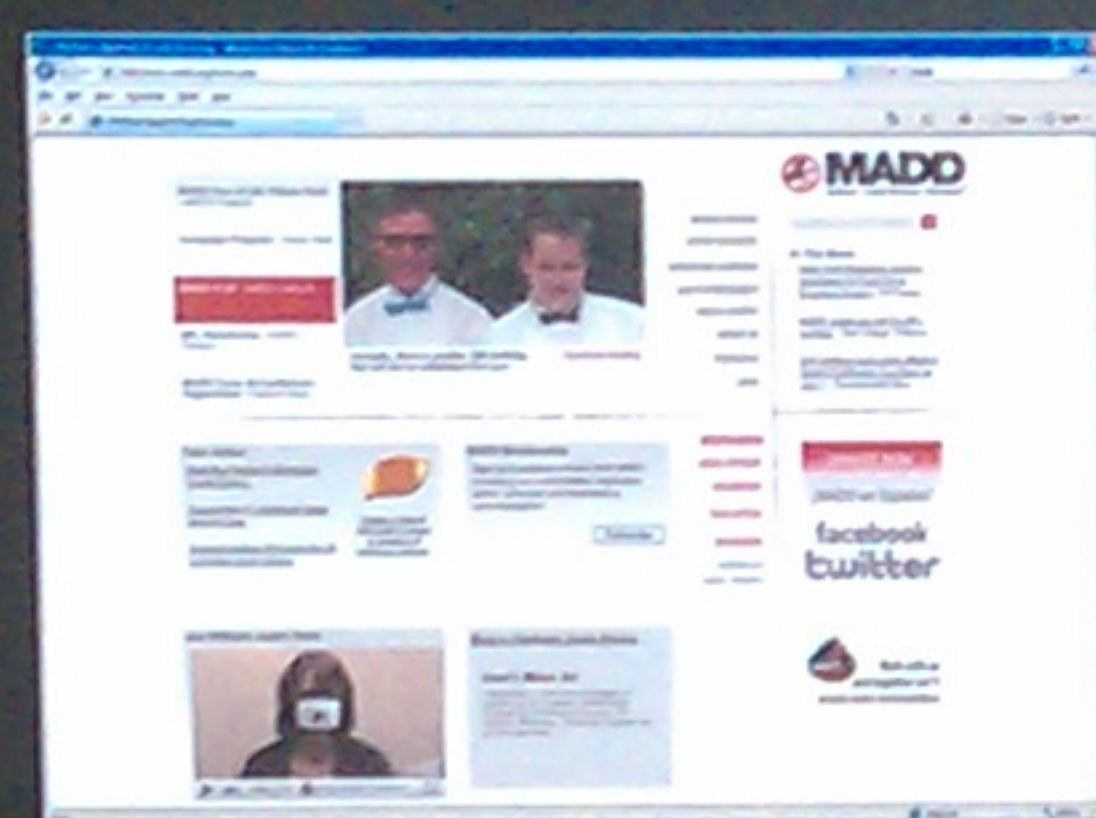


Fig. 3a Determine website you wish to copy

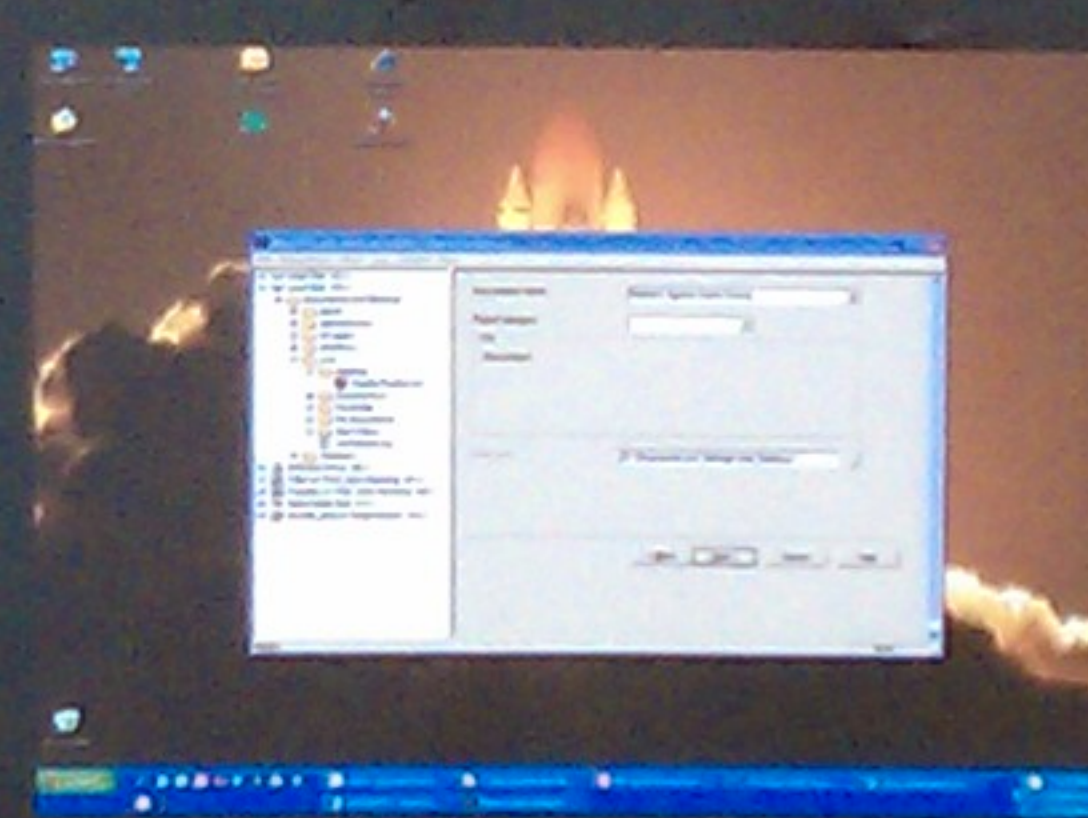


Fig. 3b Open the website copier program, name your project, select location - click NEXT

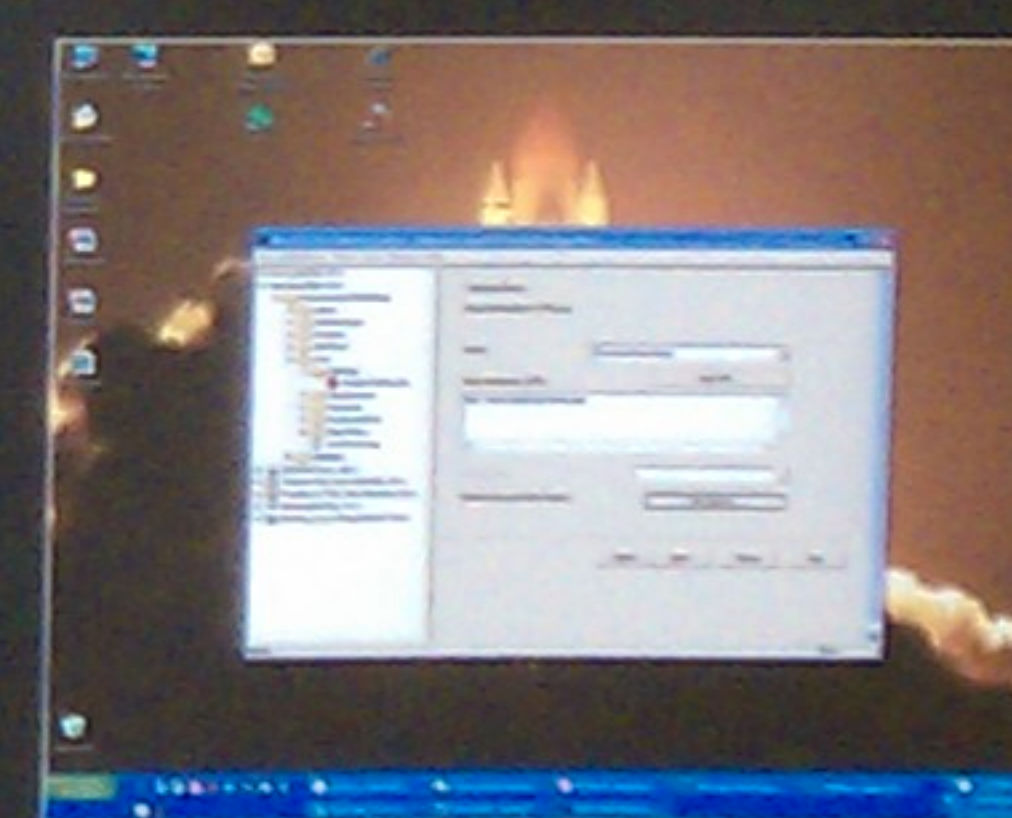


Fig. 3c Place www URL of website in the appropriate location - click NEXT

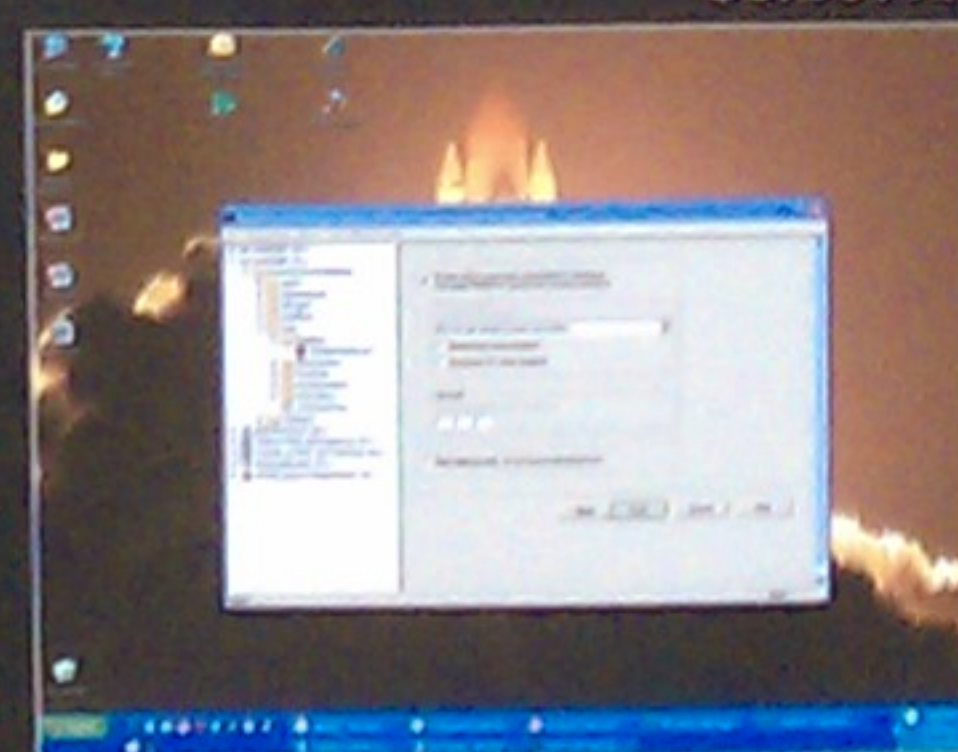


Fig. 3d Adjust Advanced Options (Usually not necessary) - click FINISH

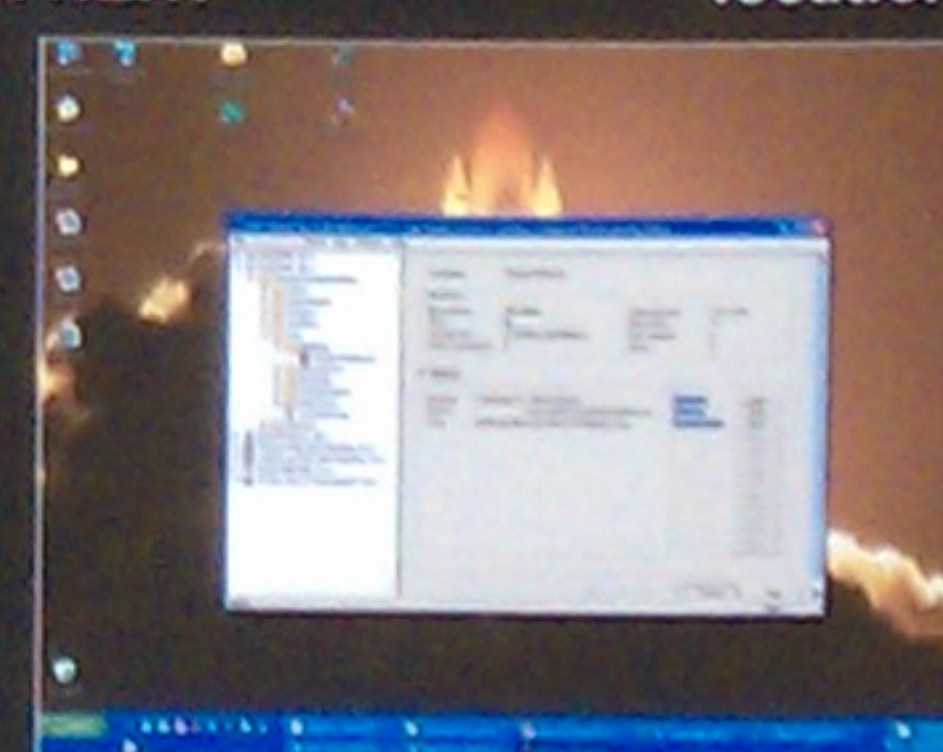


Fig. 3e Still shot of the Program doing it's thing...

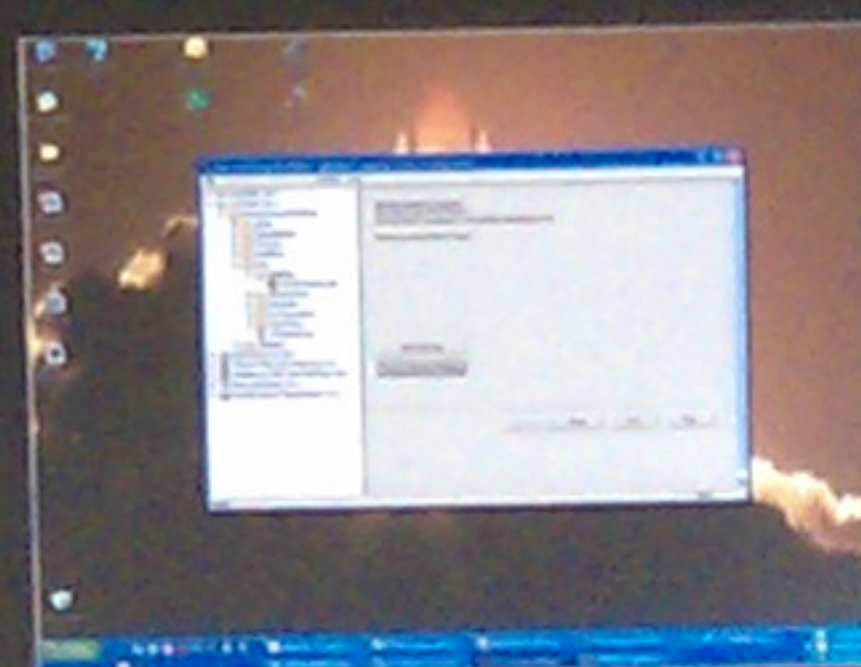


Fig. 3f Confirmation of success, availability of procedure log, and perusal of finished product are great features!

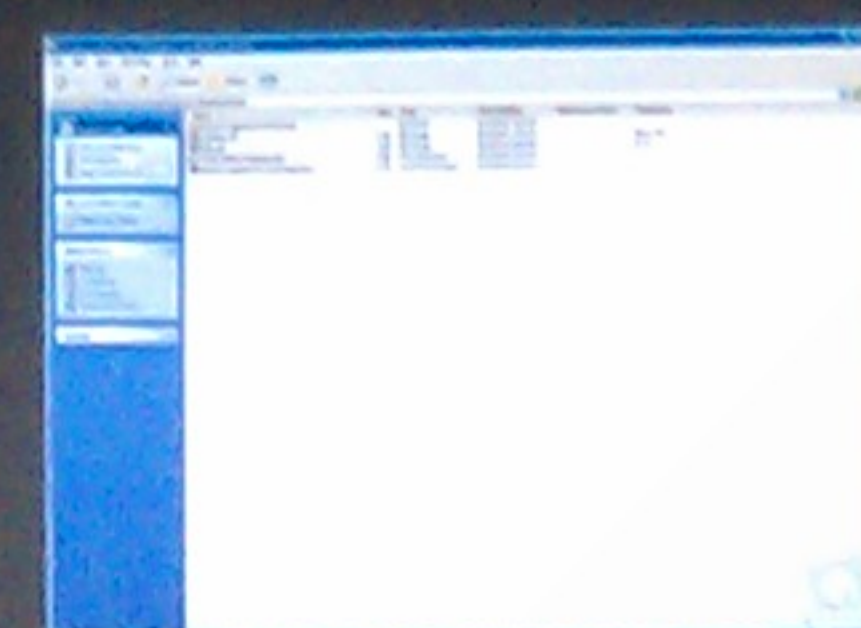


Fig. 3g Open the local folder that you chose in the beginning to store the website, locate the Explorer icon - DOUBLE CLICK



Fig. 3h Success! Be sure to Work Offline in this browser, and notice the file path name is now directed to the local folder

Conclusions

Due to character limitations in windows file-naming, a standard manual backup method would not work.

Mirroring the website, however, succeeded in creating a carbon copy of the original website to a local directory.

Although I am working with Boeing and NASA Information Technology to find a solution for a minor access issue in one of our target websites, the mirroring method has proven to be the best approach thus far in preserving the information.

Successful preserved technical information from previous program engineering websites can contribute to the development of future launch vehicle programs, and I feel fortunate of having contributed to that effort.

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 <<http://www.httrack.com/page/1/en/index.html>>.

Acknowledgments

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For further information

Please contact pinto_chris@hotmail.com. More information on this and related projects can be obtained at <http://www.httrack.com/>